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Identity of Economically Important *Amomum* spp in Tripura

Manoj Oommen[1*] . Saju K. A.[2] . Preetha V. R.[2]

[1]Spices Board, Divisional Office, Agartala, Tripura

[2]Indian Cardamom Research Institute, Regional Station, Spices Board, Sakleshpur, Karnataka

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ABSTRACT

Different species of *Amomum* are found as natural forest undergrowths in Tripura state. Identification of three major economically important *Amomum* spp which has natural occurrence quite widely in forests of Tripura was a felt need of the concerned stake holders. Spices Board in Tripura in collaboration with Department of Forest, Govt. of Tripura have undertaken this study to identify *Amomum* spp so as to add value to the supply chain of these crops for its intrinsic spice as well as medicinal uses. The study location involved Kumarghat, Manu, Jamturbari, Taidu and Khowaifung forest range in Tripura identified by the Department of Forest where *Amomum* spp occur naturally. The identified areas are delineated to concerned Joint Forest Management Committees (JFMC) of the respective locations comprising of local people mostly tribals and representatives of the Department of Forest. Each JFMC looks after the *Amomum* spp of the designated area under their purview. Three species of *Amomum* were collected, identified and documented from the study area. They are *A. coryonostachyum* Wall., *A. aromaticum* Roxb. and *A. maximum* Roxb. However the main economic activity of tribal in the study area centered around *Bheering*. *Bheering*, the economically most important produce among tribal which generates revenue for them was found to be the dried fruits of *A. corynostachyum* Wall. The present study established the scientific identity of the plants which are gaining importance as a spice and medicinal source. The characterization would definitely help in making required policies for their conservation, utilization and economic gain for the attached local communities.

1. Introduction

The North-East region of India has the greatest concentration of different genera & species belonging to *Zingiberaceae* family (Prakash and Mehrotra 1996). This family includes plants providing many useful products such as food, spices, medicines, dyes, perfume and aesthetics (Jantan *et al.,* 2003). *Amomum* Roxb. is the second largest genus after *Alpinia* in the family *Zingiberaceae* under the order *Zingiberales*. The genus consists of approximately 170 species (Lamxay and Newman 2012) distributed mainly in tropical parts of South-East Asia and widely spread in China, the Himalayas and Northern Australia also.

The plants of the genus *Amomum* are generally evergreen and are inhabitants of forest margins and light gaps in moist locations (Xia *et al.,* 2004). *Amomum* grows near the forest floor with its characteristic basal compact cone- like inflorescence (Xia *et al.,* 2004) and the fruit is berry- like with three valves packed with numerous angular seeds (De Padua *et al.,* 1999). Flowering and fruiting of *Amomum* starts around 4- 5 years after planting seedlings and the individual flowers usually lasts less than a day. Different species of *Amomum* are found as natural forest undergrowths in Tripura state. Identification of three major economically important *Amomum* spp which has natural occurrence quite widely in forests of Tripura was a felt need of the concerned stake holders.

*Corresponding author: manoj.oommen@nic.in

Spices Board in Tripura in collaboration with Department of Forest, Govt. of Tripura has undertaken this study to identify *Amomum* spp so as to add value to the supply chain of these crops for its intrinsic spice as well as medicinal uses. The study location involved Kumarghat, Manu, Jamturbari, Taidu and Khowaifung forest range in Tripura identified by the Department of Forest where *Amomum* spp occur naturally (Saha and Kaushik 2014). The identified areas are delineated to concerned Joint Forest Management Committees (JFMC) of the respective locations comprising of local people mostly tribals and the representative of Department of Forest. Each JFMC looks after the *Amomum* spp of the designated area under their purview. Some of the JFMCs have started commercially cultivating *Amomum* spp considering its economic importance. Ethnic groups like *Chakma, Kuki, Jamatia, Debbarma* and *Darlong* speaking Kok-Borok language are involved under JFMCs for this endeavour. Among tribal groups, the produce of most economical importance from *Amomum* spp is known as *Bheering* in Kok-Borok language. The members of the JFMC collect raw produce (*Bheering)* and sell it to the traders @ 15 / kg of fresh produce. Traders process the produce locally by involving JFMC members. The rate of royalty charged by the Department of Forest for dry produce is Rs. 70 / kg from the trader. The cost of production of 1 kg dry produce is estimated to be Rs. 150/- plus Rs.40/- for drying and processing, thus making the total cost of the dry produce Rs.260/- including royalty. In the year 2014-15, Ganga Trading Company (GTC) had collected the produce from Shantir Bazaar, Atharamuri area of Kumarghat Range and Karamchhara Division, Taidu Range of Gomati Division and Kowaifung area of Bagafa Division and sold it to Ayurveda companies @ Rs.400 / Kg. The tribal beneficiaries of JFMC are able to collect 30 kg (fresh) produce per day on an average and earn Rs. 450 / day during the peak season starting from July to September. About 70 tonnes of fresh produce was collected by Kailashahar Forest Division in the year 2014-15 (Saha and Kaushik 2014). The dried capsules of *Amomum* collected by JFMC members can contribute considerably to revenue generation and thereby improving the socio-economic status of the region. Increasing economic importance of the species necessitated this study to document the exact taxonomic identity thus helping the indigenous community, policy makers and general public alike for various uses and references.

2. Materials and Methods

Expedition was made to Teliamura Reserve Forest near Sampari Badal Village in Khowai District of Tripura where occurrence of Amomum is known. The purpose was to collect plant specimens for scientific identification, dried fruits for quality analysis along with photo documentation. Tentative identification was done based on the morphological and taxonomic characters. The relevant photos of the plant specimens were sent to Department of Botany, University of Calicut for confirmation of its identity. A set of specimens and photos were mounted on to herbarium sheets and deposited in the collections of Department of Botany, Tripura University and were given accession numbers. The dry and cured capsules of *Bheering* was collected through forest department (NTFP Centre of Excellence, PMU Tripura JICA Project, Agartala) and analyzed for its oil composition at Analytical Laboratory in Jawaharlal Nehru University, New Delhi. Major oil components were identified through GC-MS (Adams 2007). The oil constituents of other two produce obtained along with *Bheering* were referred from earlier reports (Lim 2013; Huong Le 2015).

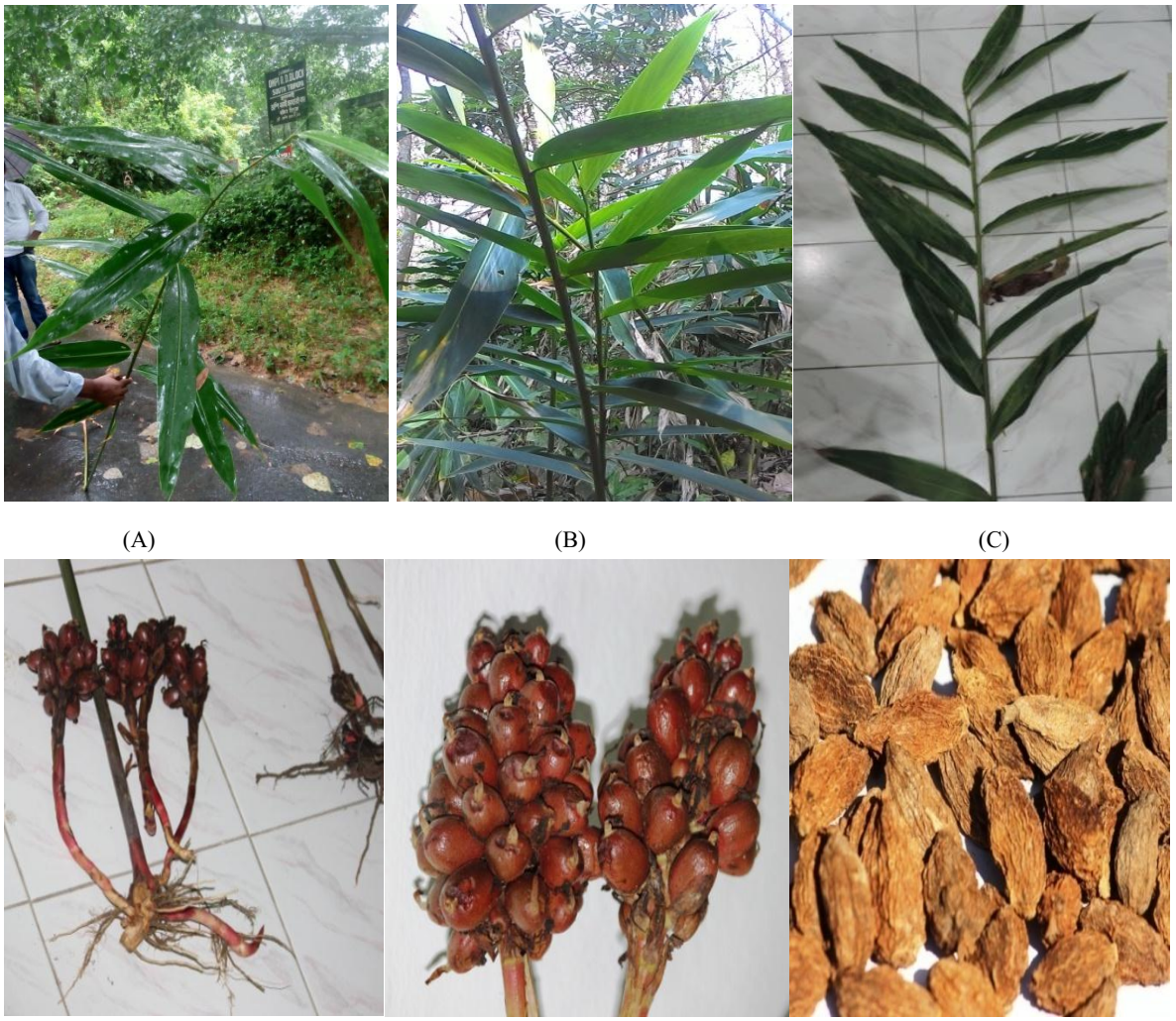
3. Results and Discussion

Three species of *Amomum* were collected, identified and documented from the study area. They are *A. coryonostachyum* Wall., *A. aromaticum* Roxb. and *A. maximum* Roxb. However the main economic activity of tribal in the study area centered around *Bheering*. The plant which produces *Bheering* was identified as *A. corynostachyum* wall. A brief botanical description of the three species along with their economic importance as spice and medicine is described as follows.

3.1 Amomum corynostachyum Wall

The most economically important species was identified as *Amomum corynostachyum* Wall. and is commonly known as Dorkim in India (Dept of Botany, Tripura University Accession No. 532 and 543). *Cardamomum corynostachyum* Wall. and *C. koenigii* (J.F. Gmel.) Kuntze. are its synonyms. *A. corynostachyum* is a perennial herb and the pseudostem reaches up to 1.5 to 2.0 metres height. Leafy pseudostem consists of sub-sessile, alternate, glabrous lanceolate leaves. Spikes are globose to subglobose produced directly from root stock. Peduncle moderately long, outer bracts oblong, pink- white corolla lobes with cuneate lip, corolla tube and lip each sized less than one inch (Plate 1).

Spike emerges from the base of the plant and flowering starts from May onwards. Harvesting season starts from August and ends by October. Capsules are globose to oblong, reddish green in colour when it is fresh and turns to reddish brown on drying. On an average, one fruit bunch weighs 500 g (fresh weight basis).



(A) (B) (C)

(D) (E) (F)

Plate 1. *Amomum corynostachyum.* A to C- The plant habit and the uprooted pseudostem showing phyllotaxy. D- Spikes with moderately long peduncle arising from the base of the pseudostem. E- Spikes with complete fruit set. F- Dried capsules.

The dry recovery of the produce ranges from 10-12 per cent. Dried capsules are 15mm to 20 mm in length and contain about 8 to 16 seeds. Capsules are dried in traditional *bhattis* (drier) using coal and fire wood as fuel. Test weight of seeds (weight of 100 seeds) ranged from 50 to 60 g.

A. corynostachyum is commercially cultivated by the local community and they use tender shoots as an ingredient in rice based preparation for adding flavor to it. Flowers of *A. corynostachyum* are eaten as vegetable (Quattrocchi 2016). *Hor* or alcoholic beverage is an integral part of the socio-cultural life of the *Karbi* tribe in Assam. *Hor Alank* is the rice beer produced by fermentation of cooked rice with locally prepared yeast called *Thap* while alcohol distilled from *Hor Alank* is called *Hor Arak*. *Thap* is traditionally prepared from leaves of *marthu* (*Croton joufra*) and water soaked rice.

Leaves of *Ku eng* (*A. corynostachyum* Wall.) and bark of *Themra* (*Acacia pinnata* Willd.) are used as substitutes of C. *joufra*. *Hor* prepared from *A. corynostachyum* based *Thap* is most favoured as it is fragrant, cooling and refreshing. *A. corynostachyum* is often used by the *Karbis* and *Jaintias* of Hamren Subdivision of Karbi Anglong District. Commercial exploitation of *A. corynostachyum* as yeast media can be carried out (Teron 2006).

The oil analysis of *A. corynostachyum* has revealed Terpinen-4-ol (60.76 %), 1, 8- cineole (17.29 %) and β-pinene (2.39 %) as major components (table 1). *Bheering*, the economically most important produce among tribal which generates revenue for them was found to be the dried fruits of *A. corynostachyum* Wall.

Table 1. Major chemical constituents of volatile oils.

Major Constituent	*A. corynostachyum*	*A. aromaticum*	*A. maximum*
Terpinen -4-ol	60.76 %	29.44 %	-
1,8- cineole	17.29 %	29.44 %	-
β-pinene	2.39 %	7.75 %	20.4- 40.8 %
α- Pinene	-	-	6.8- 15.0 %
β-elemene	-	-	2.5-12.8%

3.2 Amomum aromaticum Roxb.

The next important species was identified as *A. aromaticum* Roxb. (Dept. of Botany, Tripura University Accession No. 525). It is commonly known in many names such as Bengal cardamom, Jalpaiguri Cardamom and Nepal cardamom. *Alpinia fasciculata* (Roscoe) Steud., *Cardamomum aromaticum* (Roxb) Kuntze, *Geocallis fasciculata* (Steud.) Horan. and *Renealmia fasciculata* Roscoe are its synonyms. In Indian folk medicine, it is known as *Morang-Elaichi* (Khare, 2008). *A. aromaticum* is herbaceous perennial herb reaches up to 1 m height. Pseudostem consists of oblong - lanceolate, glabrous, 15-30 cm long and 5-10 cm wide sessile leaves. Short peduncled globose spikes are produced directly from rhizomes. Inner floral bracts are elongate, ribbed and thorn- tipped. The flowers are numerous, closely arranged, with tubular, 3-toothed calyx and tubular corolla. The corolla tube is cream in colour, tinged with brown whereas the lip is pale yellow in colour. Capsules are rugose, trigonous, oblong or globose, orange crimson in colour with a diameter of 2.5 cm to 3.0 cm (Plate 2). Mature fruits with aromatic seeds of *A. aromaticum* used in confectionary for flavouring cakes. The seeds of *A. aromaticum* have antibacterial and stomachic properties. In Vietnam, seeds are used to treat dyspepsia, flatulence, vomiting, diarrhoea, cough, chronic malaria, phlegm retention and halitosis in traditional medicine (Lim 2013). It is used in the treatment for sting and snake bite (Duke *et al.,* 2002). Rhizome is useful in treatment of diabetes (Naidu and Pullaiah 2003).

(A) (B) (C)

(D) (E)

Plate 2. *Amomum aromaticum.* A to C- The plant habit. D- Spike with short peduncle, produced directly from the rhizomes. E- Mature capsule, orange crimson in colour.

Khasi and Garo tribals in Meghalaya use its fruits for the treatment of small pox (Rao 2013). Seed decoction is used as gargle for infections of the teeth, mouth, throat and gum. Rhizome and seeds are taken as abortifacient (Quattrocchi 2016). In South India, *A. aromaticum* is a major constituent in "*Agarbatti*". It is an important constituent in Afghan "*Char masala*", a culinary spice mix. Whole fruits may be ground and powdered into rice pilafs. The husk often powdered and added to cattle feed (Duke *et al.,* 2002). Capsules contain numerous black coloured angular seeds of 3 mm length. The seeds on steam distillation yield 1-1.2 per cent essential oil, having strong camphoraceous and cineol-like odour and taste. The seeds of *A. aromaticum* contain starch, alkaloids and 1-1.2 % essential oil (table 1). The major component of essential oil is 1, 8 – cineole (29.44 %). Other components are 7-methyl-6-yl propionate (15.30 %), 2-decenal (7.75%), geraniol (5.60%), α- citonellol (6.0 %), 2-p-tolypropanal, 7 methyl-5,7- octadienal (5.25 %), 2-dodecenal (2.60 %), α- terpineole (2.60 %), α- farnesene + zingiberene (2.35 %), nerol (2.20 %), geraniol (2.20 %), p- isopropyl benzaldehyde acetate (2.0 %), α- methylcanelene acid methyl ester (1.60 %), 2-methyl-3- phenyl propanal (1.25 %), 8-methyl-2,8-nonadienol (1.10 %), 3,7- dimethyl-7-octen-2-ol (1.10%) and < 1.0 % of others such as β-pinene, α- pinene, sabinene, α-phellandrene, myrecene, limonene, β- ocimene, p-cymene,11-dodecenicacid, perylcetone *etc.* (Lim 2013).

3.3 Amomum maximum Roxb

The third species of *Amomum* collected was *A. maximum* Roxb. (Dept. of Botany, Tripura University Accession No. 591). It is commonly known as Java cardamom, Great amomum *etc.* Its synonym is *Cardamomum maximum* Kuntze. *A. maximum* is commonly known as *Aidu* and *Paro* in India (Quattrocchi 2016). *A. maximum* is eaten as lalab. Tender inflorescence and young fruits are also cooked with rice and consumed. The fresh juicy aril of ripe seeds of the species is a relished delicacy (Duke *et al.,* 2002).

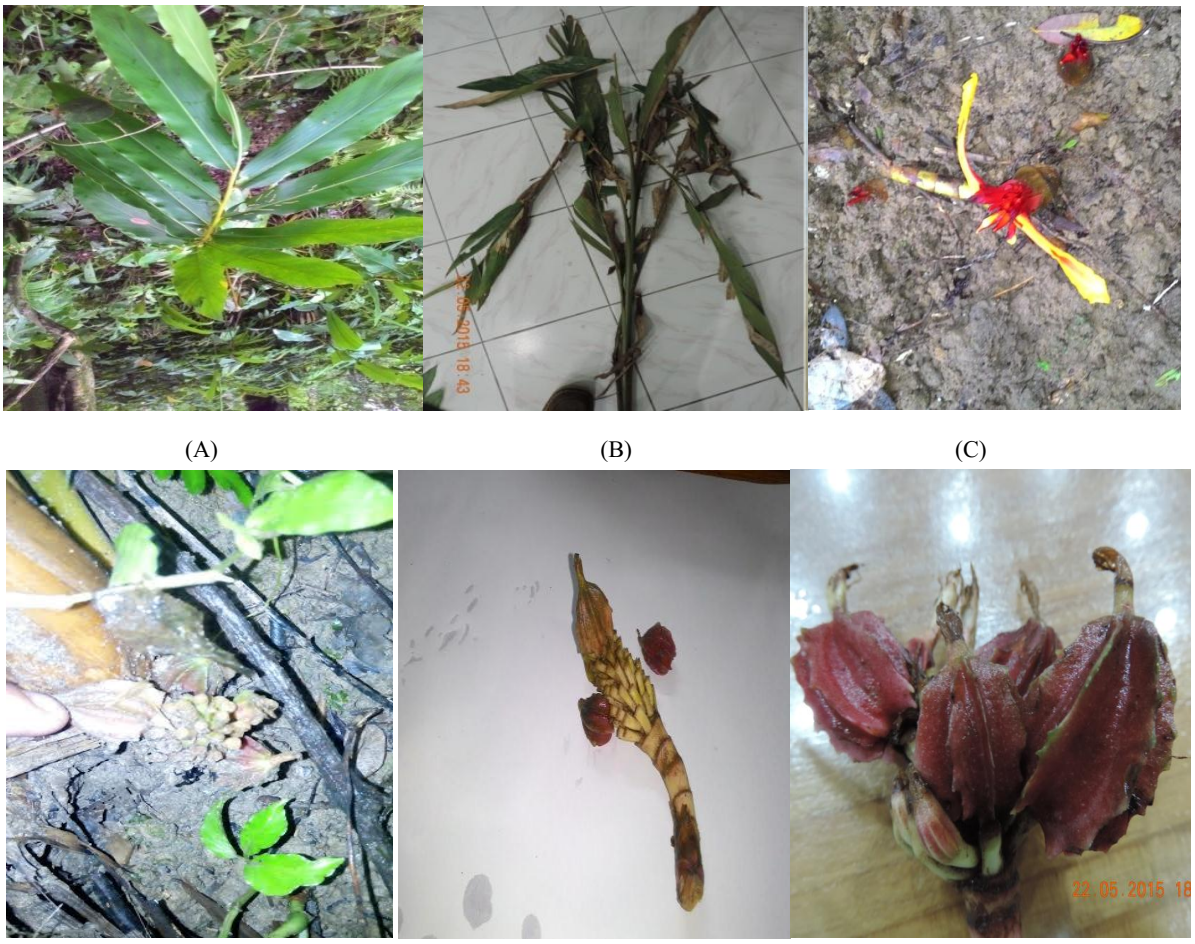


Plate 3 *Amomum maximum.* A and B- The plant habit and phyllotaxy. C. Short peduncled spike emerging directly from the rhizomes. D - F Spikes with developing and mature capsules.

A. maximum is herbaceous perennial herb reaches up to 2 m height. This species thrives well in the under storey of forest. Leafy stem consists of lanceolate, 60-90 cm long by 10-15 cm wide, petiolate leaves. Short peduncled oval spikes are produced directly from the rhizomes. Pedicel is 2-5 mm long. Bracts are lanceolate and the flowers are nearly white, with a small tinge of yellow on the middle of lip. The reddish coloured capsules are sub-globose, having nine crenulate winged ribs (Plate 3). The major compounds identified in the oil of *A. maximum* were β-pinene (20.4-40.8%), α-pinene (6.8-15.0%), β-elemene (2.5-12.8%) and β-caryophyllene (2.3-10.3%) (table 1). Moreover, β-phellandrene (11.6%) was present in the root oil (Huong le *et al.,* 2015). The fruits and seeds of *A. maximum* are used traditionally to cure stomach problems and digestive disorders in China (Qian 1985). Amomaxin B, a compound isolated from *A. maximum* exhibited nitric oxide (NO) inhibitory effect in lipopolysaccharide induced RAW264.7 (Yin *et al.,* 2013). Chetia *et al.* (2014) reported that *A. maximum* could be added to the list of natural anthelmintic. The present study established the scientific identity of the plants which are gaining importance as a spice and medicinal source. The characterization would definitely help in making required policies for their conservation, utilization and economic gain for the attached local communities.

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